Biggest takeaway(s):

A (higher LAH) + B (lower YSV) = C (greater survivability)

Regardless of the mechanism. Light may be driving it in LS. The low light treatment for LO is confusing however. It may have had the highest YSV (but still considerably less than any of the eggs from LS).

We agree the response from Lake Ontario is confusing and we do not have a great explanation. However, comparisons between lakes need to be made on the standardized scale to prevent any demographic differences (i.e., adult size or egg size) from being misinterpreted as a light effect. Using the standardized scale, the magnitude of response in LAH and YSV for Lake Ontario is much smaller than Lake Superior. Perhaps Lake Ontario cisco have a greater degree of phenotypic plasticity to withstand higher light intensities and the result on larval survival and performance does not matter. This is a testament to the amount of developmental plasticity in coregonines. Taking the approach of A + B = C may work for one lake but not the other based on local conditions. This was not meant to be a critique, just a caution of oversimplification.

Biggest comment(s):

-I really wish there was more comment about snow influence. I understand that would be another dataset to include. So issue at this point. The combination of ice and snow (somewhat already mentioned in the paper) would be another worthwhile study.

We did not have a way to measure snow on top of ice so we limited our text on snow. We know the relationship between snow cover over ice and light is strong, we just did not have the ability to incorporate snow into our light observations in the field. Snow above the ice is difficult to measure via satellite and dangerous to sample safely on Lake Superior with variable ice conditions and the large distance from shore – technology needs to advance more until this question can be addressed, but you are correct that it is certainly warranted. We assume the reviewer meant “**No** issue at this point.”

The impact of snow on runoff and implications on the cisco hatching environment is an increasingly interesting question with land use and seasonal snowfall changes.

-The collection of light data only at LS was difficult to get my head around throughout the paper.

Would converting this to a proportional light intensity for LO (based on <5m depth at spawning site) do anything for the results? It becomes an apples to oranges comparison possibly. Obviously not something to do now. Just something to explicitly state in figures and methods.

I think it still works and the variability component described in LO drives the idea of separate populations adaptability under a range of light intensities.

We added a sentence in the Methods to be explicit that no light data was measured for Lake Ontario and incorporated the reviewer’s other in-text suggestions about this. The proportional light relationship is a good thought but more complicated from a physics perspective than it seems. We would need to know attenuation coefficients of each location (i.e., what other factors limit light absorption and how are they different at each location) to apply Lake Superior measurements to Lake Ontario. Definitely an apples to oranges comparison.

-I spent a lot of time thinking about how smaller LAH and higher YSV COULD be a good thing in LS. Probably too much attempting to square peg, round hole fit something into a narrative.

A fish is small, doesn't have to consume as much at hatch. A larger yolk-sac means you can wait longer for exogenous feeding. Its a trade-off that MAY work.

But fitting that with the survivability figure, it just doesn't jive when comparing it with LO. And I think as you guys mentioned, larger yolk sac influences swimming ability (can't evade, can't start feeding).

I included a couple of comments about papers that deal with trade-offs and size at hatch (predators may prefer larger food, not slower food).

But that may only be applicable in theory or experimentally.

A lot of early hatched larvae here are not exactly the most able-bodied swimmers and also have higher mortality rates.

We were not able to study the impact of light during incubations on larvae because of laboratory limitations for animal care and space (we opted to look at the effect of incubation temperature on larvae - manuscript in preparation), but this is a huge question begging to be asked now that we know light does have an impact on embryos. Many of the individuals that hatched early died almost immediately in the microplate wells. Because we were not able to extend our experiment into the larvae life stage, we can only speculate how embryo light exposure would impact larvae so we tried to keep our interpretations to a minimum. Certainly a promising future research topic, just outside of our infrastructure ability due to reduced personnel for experimental maintenance from COVID.

-Does a 10-15% difference in survivability per year per lake make a big difference in a population? Likely not. But over decades, maybe that is, or will continue to be, a driver.

I don't see cause for alarm over the 85% to 90% in a one off. But then comparing it to LO....at near 100%.

To see almost no mortality at any of the light treatments is interesting. That combined with the apparently larger historical ice coverage over the spawning areas, maybe there is something there.

To put the survival rates into perspective, we saw similar overall differences in survival between Lake Superior and Lake Ontario when light was not an experimental factor (Stewart et al. 2021). This incubation method provides optimal incubation conditions (i.e., sterility and no disturbance), which leads to very high survival. However, this would not be expected in the wild, or even a hatchery, and should result in lower survival and potential interactions with other variables. That is, if light increases metabolic demand and increased turbidity causes higher sedimentation around an embryo, this will reduce oxygen concentrations and potentially intensify the impact of light.

Additionally, I would caution anyone to not read into any differences between lakes (i.e., 85% vs. 100%) on the raw scale (left side of figures) too much. The response within each population and the standardized scale (right side) is far better suited for this type of interpretation. See comment above.

The ADD and DPF I didn't give enough credit to until writing this. For there to be standardization across treatments for temperature and still see this stark difference in the averages. Pretty interesting. Alot of implicit things about the parents and local populations that isn't stated.

We are uncertain what the reviewer is asking, if anything, so we have not addressed this comment.

A couple of corrections in the references.

Done.

Some minor comments about phrasing throughout.

Done.

Gave me some pause about our lab conditions, what's adequate, what aren't we thinking about.